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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/518,025	12/15/2004	Hitoshi Kato	263261US0PCT	4998
22850	7590	09/19/2005		
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER HARRISON, MONICA D	
			ART UNIT	PAPER NUMBER
			2813	
DATE MAILED: 09/19/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/518,025

Applicant(s)

KATO ET AL.

Examiner

Monica D. Harrison

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12/15/04.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 December 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/15/04
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Priority*

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-6 and 10-15 are rejected under 35 U.S.C. 102(e) as being anticipated by Kumangi et al (2005/0095770 A1).

The applied reference has two common inventors and assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention “by another,” or by an appropriate showing under 37 CFR 1.131.

2. Regarding claim 1, Kumangi et al discloses a CVD method for forming a silicon nitride film on a target substrate, the method comprising: heating (Figure 1, reference 12; pg.2, paragraph 0015) the substrate (Figure 1, reference W) accommodated in a process container (Figure 1, reference 8), at a process temperature (pg.3, paragraph 0040); and supplying a process

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gas including hexaethylaminodisilane gas and ammonia gas onto the substrate heated at the process temperature, thereby depositing a silicon nitride film on the substrate (pg.6, paragraph 0091).

3. Regarding claim 2, Kumangi et al discloses wherein the process temperature is set to be within a range from 100 to 600 degrees Celsius (pg.1, paragraphs 0004 and 0006).

4. Regarding claim 3, Kumangi et al discloses a ratio of a flow rate of the ammonia gas relative to a flow rate of the hexaethylaminodisilane gas is set to be within a range of from 30 to 200 (pg.1, paragraph 0011).

5. Regarding claim 4, Kumangi et al discloses wherein depositing the silicon nitride film comprises supplying the process gas into the process container while exhausting the process container, thereby setting the process container to have a process pressure of from 27 to 1333 Pa (pg.3, paragraph 0041).

6. Regarding claim 5, Kumangi et al discloses wherein the process container is configured to accommodate a plurality of target substrate at intervals in a vertical direction (Figure 1, reference 20), and the target substrates is heated by a heater (Figure 1, reference 12) disposed around the process container (Figure 1, reference 8).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6 and 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumangi et al (US 2005/0095770 A1) in view of Hausmann et al (6,475,902 B1).

7. Regarding claim 6, Kumangi et al discloses a CVD method for forming a silicon nitride target substrate, the method comprising: heating (Figure 1, reference 12) the substrate (Figure 1, reference W) accommodated in a process container (Figure 1, reference 8), at a process temperature (pg. 3, paragraph 0040); and alternately supplying a first process gas including hexaethylaminodisilane gas and a second process gas including ammonia gas in cycles onto the substrate heated at the process temperature, thereby depositing a silicon nitride film on the substrate (pg. 6, paragraph 0091).

However, Kumangi et al does not disclose wherein supplying the second process gas comprises turning the second process gas into plasma, for excitation (claim 6), wherein the second process gas is excited while passing through a plasma generating area which is disposed in a space communicating with the process container and between a supply port of the second process gas and the substrate (claim 12), wherein the process container is provided with an electrode and an RF power supply, and the plasma generating area comprises an RF electric field formed between the supply port of the second process gas and the substrate by the electrode and the power supply (claim 13), wherein the process container is configured to accommodate a plurality of target substrates at intervals in a vertical direction, and the target substrates are heated by a heater disposed around the process container (claim 14) and wherein the first and second process gases are supplied from a plurality of first gas spouting holes and a plurality of second gas spouting holes, respectively, to form gas flows parallel with the target substrates, and each

group of the first gas spouting holes and the second gas spouting holes are arrayed over the target substrates in a vertical direction.(claim 15).

Hausmann et al discloses supplying the second process gas comprises turning the second process gas into plasma for excitation (column 8, lines 27-32), wherein the second process gas is excited while passing through a plasma generating area which disposed in a space communicating with the process container and between a supply port of the second process gas and the substrate (column 18, lines 10-35), wherein the process container is provided with an electrode and an RF power supply, and the plasma generating area comprises an RF electric field formed between the supply port of the second process gas and the substrate by the electrode and the power supply (column 14, lines 26-37), wherein the process container is configured to accommodate a plurality of target substrate at intervals in a vertical direction, and the target substrates is heated by a heater disposed around the process container (Figures 4 and 5; column 14, lines 11-18 and 58-67 thru column 15, lines 1-11)) and wherein the first and second process gases are supplied from a plurality of first gas spouting holes and a plurality of second gas spouting holes, respectively, to form gas flows parallel with the target substrates, and each group of the first gas spouting holes and the second gas spouting holes are arrayed over the target substrates in a vertical direction.(column 15, lines 48-53).

Since Kumangi et al and Hausmann et al are both from the same field of endeavor, the purpose disclosed by Hausmann et al would have been recognized in the pertinent art of Kumangi et al.

It is obvious, at the time the invention was made, for one with ordinary skill in the art, to modify Kumangi et al with the teachings of Hausmann et al, for the purpose of depositing a

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metal nitride material, formed by the decomposition of an organometallic precursor, useful as a barrier layer for an integrated circuit using a conducting metal.

Claims 7-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kumangi et al (US 2005/0095770 A1).

8. Regarding claims 7-11, Kumangi et al discloses the process gas time (claim 7; pg. 1, paragraph 0018), silicon nitride deposition thickness (claim 8; pp. 6-7; paragraphs 0090 and 0096), purging of the process container comprising exhausting the gasses (claim 9; Figure 1, reference 39; pg. 3, paragraphs 0041-0042), process temperature (claim 10, pg. 3, paragraph 0040) and the flow rates of ammonia and hexaethylaminodisilane gas (claim 11; pg. 6, paragraph 0090).

However, Kumangi et al does not disclose wherein each cycle is arranged to supply the first process gas for 1 to 60 seconds, and to supply the second process gas for 1 to 60 seconds (claim 7), wherein supply rates and supply periods of the first and second process gases in each cycle are set such that, when the first and second process gases are supplied once for each, a silicon nitride film thereby formed preferably has a deposition thickness of from 0.05 to 0.5 nm (claim 8), wherein the purging of the process container comprises exhausting the process container while stopping the first and second process gases (claim 9), wherein the process temperature is set to be within a range of from 300 to 600V (claim 10) and, wherein a ratio of a flow rate of the ammonia gas relative to a flow rate of the hexaethylaminodisilane gas is set to be within a range of from 30 to 200 (claim 11).

It would have been obvious, at the time the invention was made, for one having ordinary skill in the art, to provide the specified ranges of the above claims 7-11, since it has been held

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that where the general conditions of a claim are disclosed in the prior art, discovering the "optimum range" involves only routine skill in the art. *In re Aller*, 105 USPQ 233 (1955).

**Conclusion**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica D. Harrison whose telephone number is 571-272-1959. The examiner can normally be reached on M-F 7:00am-3:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Monica D. Harrison  
AU 2813

mdh  
September 14, 2005

LAURA M. SCHILLINGER  
PRIMARY EXAMINER

